Navy Personnel Research and Development Center
San Diego, California 92152-6800 TN-91-4 January 1991

(3)

AD-A231 302

Development of a USMC Officer Assignment Decision Support System: General Design Specification

Robert E. Chatfield
Stephanie A. Gullett

NPRDC-TN-91-4

January 1991

Development of a USMC Officer Assignment Decision Support System: General Design Specification

Robert E. Chatfield
Stephanie A. Gullett

Reviewed by
Emanuel P. Somer

Approved and released by
Jules I. Borack
Director, Personnel Systems Department

Approved for public release;
distribution is unlimited.

Navy Personnel Research and Development Center
San Diego, California 92152-6800

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
January 1991

3. REPORT TYPE AND DATES COVERED
Tech Note--Oct 86-Dec 86

4. TITLE AND SUBTITLE
Development of a USMC Officer Assignment Decision Support System: General Design Specification

5. FUNDING NUMBERS
Program Element 0603732M,
Work Unit M5402688WRRD8FY

6. AUTHOR(S)
Robert E. Chatfield, Stephanie A. Gullett

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Navy Personnel Research and Development Center
San Diego, California 92152-6800

8. PERFORMING ORGANIZATION REPORT NUMBER
NPRDC-TN -91-4

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
USMC Manpower Systems Development and Integration Branch (MI-40)
Washington, DC 20380-0001

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This general design specification was completed as part of the Life Cycle Management (LCM) process for development of an Officer Assignment Decision Support System (OADSS). This document details users' requirements for enhanced capabilities for carrying out assignment of Marine Corps officers and describes the Automated Data Processing Equipment (ADPE) environment required to meet the proposed system's objectives. Deficiencies in the current assignment system, as well as capabilities of the proposed system designed to correct them, are summarized. General design specifications are based primarily upon derivation of the New Physical Model that was established via prescribed structured analysis techniques. This model is composed of three primary components: (1) data flow diagram, (2) data dictionary, and (3) mini-specifications governing the transformation of input data flows that mini-systems perform at the primitive functional level. A Data Flow Diagram (DFD) is provided to graphically represent data flows into and out of the seven functional mini-systems (processors). Also, an Entity-relationship Diagram (ERD) is presented that partitions data elements into homogeneous groups or entities. Finally, factors such as organizational context, new performance characteristics, and information requirements affecting system development are discussed as well.

14. SUBJECT TERMS
Officer assignment, decision support system, automated information

15. NUMBER OF PAGES
41

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

FOREWORD

This report describes, in general terms, the structure of the data base to be included in the Officer Assignment Decision Support System (OADSS) designed to improve officer assignment procedures in the United States Marine Corps (USMC). Among deficiencies in the current assignment system are the labor-intensive review of hard copy-based information, need for a comprehensive and centralized data base, and lack of standardization among officer Monitors in their assignment strategies. Monitors critically need interactive, computer-based support for assignment decisions because of the volume of assignment-related information available and the vast number of assignment alternatives to be weighed.

This is the seventh in a series of reports that detail the "concept development" and "definition and design" phases of the USMC Life Cycle Management (LCM) process associated with OADSS. The research was conducted under program element 0603732M, work unit M5402688WRRD8FY, Marine Corps Decision Support System for Officer Assignment, sponsored by the Manpower Systems Development and Integration Branch (MI). This report is based upon the General Design Specification (GDS) that was submitted to MI in December 1986. The present report has been revised to be somewhat less technical in content and serves as a guide for other researchers tasked with drafting LCM documentation. Future publications will include a Detailed Design Specification (DDS) and descriptions of implementing system module prototypes.

JULES I. BORACK
Director, Personnel Systems Department

PRIOR OFFICER ASSIGNMENT DECISION SUPPORT SYSTEM PUBLICATIONS

Chatfield, R. E. (1988). *Development of a USMC officer assignment decision support system: Needs assessment* (NPRDC-TN-88-50). San Diego: Navy Personnel Research and Development Center. (AD-A198353)

Chatfield, R. E., & Gullett, S. A. (1989). *Development of a USMC officer assignment decision support system: Feasibility study* (NPRDC-TN-89-14). San Diego: Navy Personnel Research and Development Center.

Chatfield, R. E., & Gullett, S. A. (1989). *Development of a USMC officer assignment decision support system: Economic analysis* (NPRDC-TN-89-36). San Diego: Navy Personnel Research and Development Center.

Chatfield, R. E., & Gullett, S. A. (1989). *Development of a USMC officer assignment decision support system: Functional description* (NPRDC-TN-89-32). San Diego: Navy Personnel Research and Development Center.

Chatfield, R. E., & Gullett, S. A. (1989). *Development of a USMC officer assignment decision support system: Data requirements* (NPRDC-TN-90-12). San Diego: Navy Personnel Research and Development Center.

Chatfield, R. E., & Gullett, S. A. (1991). *Development of a USMC officer assignment decision support system: Project management plan* (in process). San Diego: Navy Personnel Research and Development Center.

SUMMARY

Background

Officer Monitors need support in their decision-making process due to the volume of assignment-related information to be considered and the vast number of assignment alternatives to be weighed. It is anticipated that a user-friendly, interactive Officer Assignment Decision Support System (OADSS) will help Monitors better implement USMC staffing policy, significantly reduce their clerical workload, and enhance the match of officers to billets.

Purpose

The purpose of this general design specification was to: (l) detail users' requirements for new, revised, or enhanced capabilities in carrying out assignment of Marine Corps officers, and (2) describe the Automated Data Processing Equipment (ADPE) environment required to meet the proposed system's objectives.

The New Physical Model

The OADSS is being developed to provide an easy-to-use, interactive automated information system for use by Monitors in the assignment process. However, OADSS will strictly serve as a computer-based decision aid and is not intended to automate assignment decisions. Deficiencies in the current assignment system as well as capabilities of the proposed system designed to correct them are summarized. Deficiencies in the present system include: (l) lack of standardization among Monitors in assignment decision-making strategies, (2) lack of user-friendly procedures for ad hoc query and data retrieval, (3) manual, labor-intensive procedures for reviewing assignment-relevant data, and (4) inadequate and informal training for Monitors. The proposed system will support existing functional capabilities as well as provide new features such as: (l) development of specialized, computer-based training for orientation of new Monitors, (2) inclusion of "applications generator" technology to promote user-friendliness in ad hoc query and report generation, (3) expanded scope of computer-resident data to include information critical for the assignment process that is presently not readily available, and (4) computerization of procedures that are currently conducted via slow, manual processing.

General Design Specification

Design specification for OADSS is based primarily upon derivation of the New Physical Model that was established via prescribed structured analysis techniques. The model is essentially a refinement of the logical model presented in the earlier Functional Description (FD) (Chatfield & Gullett, 1988). That is, each model is composed of three primary components: (l) data flow diagram, (2) data dictionary, and (3) mini-specifications governing the transformation of input data flows into output data flows that mini-systems perform at the functional primitive level. The model's organization is structured to reduce complexity by partitioning into functional subsystems. A detailed Data Flow Diagram (DFD) is presented to graphically represent data flows into and out of the seven functional mini-systems (processors). A "leveled set" of DFDs is presented to detail the top-down modeling process and interrelationship among mini-systems. Also, an Entity-relationship Diagram (ERD) is presented that partitions elements from the data dictionary in the

earlier data requirements publication (Chatfield & Gullett 1990) into homogeneous entities. Finally, factors such as organizational context, ADPE environment performance characteristics, and information requirements affecting system development are discussed as well.

Recommendations

1. A Detailed Design Specification (DDS) should be completed by the system designer (i.e., NPRDC) as the next step in the "definition and design" phase of system development.

2. In concert with the modular approach to system development, "rapid prototyping" should be used as a means of minimizing system development time and ensuring the active participation of end users.

CONTENTS

INTRODUCTION 1

Background 1
Purpose 2
Project References 2
Approach 3

THE NEW PHYSICAL MODEL 4

System Objective 5
Deficiencies in the Present System 5
Capabilities of the Proposed System 6
Scope 6

GENERAL DESIGN SPECIFICATION 7

Structured Specification 7
Conceptual Model Organization 7
Data Flow Diagram (DFD) 8
Context Diagram 8
Leveled Set of Data Flow Diagram Components 11
Figure 0 11
Child Diagrams 11
Mini-specification 13
Information Modeling 13
Organizational Context 16
Automated Data Processing Equipment (ADPE) Environment 17
Marine Corps Central Design and Programming Activity (MCCPA), Quantico 18
Officer Assignment Branch (MMOA) 18
Software Environment 19
New Performance Characteristics 19
Information Requirements 23

RECOMMENDATIONS 24

APPENDIX A--TERMS AND ABBREVIATIONS A-0

APPENDIX B--CHILD DIAGRAMS B-0

DISTRIBUTION LIST

LIST OF FIGURES

1. Data flow diagram (DFD) 9
2. Context diagram 10
3. Level 1: Figure 0 of the leveled set 12
4. Summary of relationship between officer assignment decision support system (OADSS) subsystems and modules 14
5. Entity-relationship diagram (ERD) 14
6. Organization of the officer assignment branch (MMOA) 16
7. Special education program (SEP) administration module 20
8. Annual slate letters/monitor notes 20
9. Officer promotion database module 21
10. Improved database access module 21
11. Automated monitor orientation subsystem (AMOS) module 22
12. Officer staffing goal model (OSGM) interactive maintenance module 22

INTRODUCTION

Background

The mission of the Officer Assignment Branch (MMOA), located at Headquarters, United States Marine Corps (HQMC) is to administer assignment of all Marine Corps officers (colonel and below) in accordance with regulations, approved assignment policies, and criteria of the Commandant of the Marine Corps (CMC). Functions carried out in support of this mission include: issuing travel orders; classifying/reclassifying officers in occupational specialties; and assigning officers to career, intermediate, and top-level schools. The individuals within MMOA who make assignment decisions (subject to approval by higher authority) are referred to as officer "Monitors." Monitors have a very difficult job in that they are expected to accommodate both the manning requirements of the Marine Corps and the career/personal needs of officers via the assignment process. Performing this task requires concurrent consideration of the job dimensions of available billets and the skills and attributes of officers being assigned.

Monitors' first consideration in staffing is the "fill" of available billets, while the next is the "fit" of officers to specific billets based upon their education, work experience, Military Occupational Specialty (MOS), etc. The process of reaching an assignment decision may involve accessing on-line personnel databases such as the Joint Uniform Military Pay System/Manpower Management System (JUMPS/MMS), reviewing Officer Fitness Reports (FITREPS) on microfiche, talking with constituents in person or on the telephone, or reviewing a number of other relevant sources of information. In conjunction with this, Monitors must also be mindful of established staffing policy, United States Marine Corps (USMC) manning levels, and the career development needs of individual officers when weighing assignment alternatives.

The idea for establishing an Officer Assignment Decision Support System (OADSS) came about because it was evident that Monitors need support in their decision-making process due to the vast amount of assignment-related information to be considered and the number of assignment alternatives to be weighed. It is anticipated that a truly user-friendly, interactive Decision Support System (DSS) will help Monitors better implement USMC staffing policy, significantly reduce their clerical workload, and enhance the match of officers to billets.

The original effort to develop a DSS for Monitors was carried out by a contractor as part of the Officer Precise Personnel Assignment System (Officer PREPAS) in 1979. However, this work stressed an optimization approach to officer assignment and was terminated in the early concept development stage of the Life Cycle Management (LCM) process. A subsequent contractor effort to build OADSS, in 1981, was also terminated in the concept development stage as it also relied too heavily upon optimization techniques and was not sufficiently interactive. Both of these attempts were doomed to failure as the Marine Corps objected to any "black box" (i.e., optimization) approach perceived to automate the assignment process. The goal was to <u>support</u> Monitors in their decision-making, not to make assignment decisions for them.

The idea for developing the OADSS lay dormant until 1985 when support for a third attempt at system development became available at the Navy Personnel Research and Development Center (NPRDC). The project sponsor, the Manpower Systems Development and Integration Branch (MI), specified that system design be carried out by Personnel Research Psychologists rather than

Operations Researchers or Computer Specialists under the assumption that this would avoid yet another optimization-oriented approach that would prove unacceptable to the CMC. Also, it was Manpower Management Information (MPI) Systems Branch assumption that the psychologists could better assess Monitors' needs and translate them into design of a system that was easy to access and truly user-friendly.

In compliance with the USMC Life Cycle Management Plan of Automated Information Systems (LCM-AIS), Marine Corps Order P5231.1, a combined General Design Specification/ Detailed Design Specification (GDS/DDS) was submitted to MPI in December 1986. This current technical note is based upon the General Design Specification (GDS) submitted to MPI and has been revised to be somewhat less technical in content. This report can also serve as a guide for other researchers tasked with drafting LCM documentation.

Purpose

The GDS details users' requirements for new, revised, or enhanced capabilities in carrying out the assignment of Marine Corps officers. In addition, it details the Automated Data Processing Equipment (ADPE) environment required to meet the proposed system's stated purpose. Paired with information about applications software provided in the Detailed Design Specification (DDS), this document will provide a complete overview of what is required to implement a "prototype" OADSS.

Project References

A variety of publications were reviewed throughout the course of GDS development. Among the most important are the following:

Automated Data System (ADS) Plan for the Officer Precise Personnel Assignment System (Officer PREPAS), Potomac Research Incorporated and General Research Corporation, 15 September 1979. This report presents a proposal for development of the Officer PREPAS System and an assignment management information system.

Development of Specifications for the Officer Assignment Decision Support System, Andrulis Research Corporation, 25 February 1981. This report presents a proposal for development of an officer assignment system based on optimization strategies.

Officer Staffing Goal Model (OSGM): Design Specifications, Decision Systems Associates, June 1978. This report contains a description of the function, logic, and data definitions of the OSGM at the time of development.

Users Manual: Officer Staffing Goal Model (OSGM), Decision Systems Associates, September 1984. This manual describes how to create and run an OSGM job.

Marine Corps Personnel Assignment Policy, Marine Corps Order 1300.8M, 2 May 1984. This Marine Corps Order (MCO) implements Department of Defense policy and provides policy guidance relative to assignment and permanent change in station (PCS) of Marines.

Officer Assignment Branch Slating Guidance Memorandum, Director, Personnel Management Division, 18 October 1982. This memorandum provides guidance for the slating process, amplifies existing instructions, and establishes branch policies not covered elsewhere.

Joint Uniform Military Pay System/Manpower Management Systems Code Manual, Marine Corps Order P-1080.20, current to 11 December 1984. This manual contains definitions used in the JUMPS/MMS and REMMPS system.

Staffing Precedences for Officer and Enlisted Billets, Marine Corps Order 5320.12, 22 June 1982. This MCO establishes personnel management guidance and staffing precedences for officer and enlisted billets in Marine Corps Commands.

Life Cycle Management for Automated Information Systems (LCM-AIS), Marine Corps Order P-5231.1, 9 August 1983. This MCO establishes policies, procedures, and regulations governing the development, operation, and management of automated information systems.

System Development Methodology: Volume III Standards, Marine Corps Order P5231.1A, Draft of June 1986. This MCO modifies the policies, procedures, and regulations presented in Marine Corps Order P5231.1A and includes several new documentation requirements.

Automated Data Systems (ADS) Documentation, Department of Defense Standard 7935, 15 February 1983. This document provides Department of Defense (DoD) guidelines for the development and revision of documentation for ADSs and describes technical documents to be produced throughout the life cycle of an ADS.

Approach

The GDS represents the product of structured systems analysis; specifically, the New Physical Model. This model defines the operational environment of the proposed system and includes the following elements:

1. General information about system objectives, scope of development activities, responsibilities of the system development team, and other cogent recommendations.

2. Context Diagram, or, in the case of a designated subsystem, a Relative Context Diagram.

3. A leveled set of Data Flow Diagrams (DFDs) comprised of a Figure 0 and associated child figures inclusive to the functional primitive level.

4. Mini-specifications for all functional primitives declared on the lowest level child figures.

5. References to the Data Dictionary included in the earlier Data Requirements Document (DRD) for all data declared on the DFDs.

6. Relevant supplemental information such as performance characteristics, ADPE environment, and summaries of required changes to current operational procedures.

In the interest of promoting readability, the terms, definitions, and acronyms used throughout the GDS are presented in Appendix A.

As indicated in Marine Corps Order P5231.1A, modeling the General Design is the second step in the prescribed method of structured systems analysis. This step builds upon information provided in the earlier Functional Description (FD) and DRD. The completed General Design considers the physical constraints (office space, equipment, etc.) attendant to both the organizational and technological limitations of the new system's operational environment. Specifically, the following factors are considered:

1. The capacity, capability, and efficiency of the operative hardware and software environment.

2. The organizational responsibilities (i.e., mission) and job descriptions related to the implementation environment.

3. The geographical allocations required in the new requirements; specifically, as the proposed system interfaces with the Marine Corps Central Design and Programming Activity (MCCDPA), Regional Automated Service Center (RASC), or Deployable Force Automated Service Center (DFASC).

4. The anticipated or desired performance characteristics of the new system.

In developing the General Design, essential and custodial functions are allocated to a endant physical processors based on a careful assessment of the planned implementation environment and data requirements are modeled to meet the physical reporting and storage requirements of the new system. Finally, implementation-dependent functions are added to the model to perform administrative tasks such as edits, audits, data validation, and report formatting. The General Design process is considered to be complete with production of a New Physical Model that includes.

1. Delineation of all functions necessary to meet the new system's stated purpose following implementation.

2. A description of all data required to satisfy the new system's stated purpose following implementation.

3. A discussion of all man-machine interfaces; specified at the topmost level.

THE NEW PHYSICAL MODEL

This section describes the New Physical Model as developed in accordance with documentation requirements set forth in the draft version of "System Development Methodology, Volume III: Standards of Marine Corps Order P5231.1A (Supplement Number 7: General Design Specification Standard)."

System Objective

The OADSS is being developed to provide an easy-to-use, interactive automated information system for use by officer Monitors in the assignment process. However, OADSS will strictly serve as a computer-based decision aid and is not intended to automate assignment decisions. The proposed system will free Monitors from the manual, labor-intensive review of data elements and thus provide more time for interacting with constituents, ensuring assignments comply with staffing guidance, and weighing assignment alternatives. The deficiencies in the current assignment system as well as the capabilities of the proposed system designed to correct them are briefly summarized below.

Deficiencies in the Present System

User requirements are not adequately met by the present system due to the following deficiencies:

1. There is a lack of standardization among officer Monitors in assignment procedures and associated decision-making strategies. Much of this variation in Monitor "style" is attributable to the lack of adequate training/orientation procedures.

2. Existing methods of searching, sorting, and displaying data (ad hoc query and data retrieval) with the existing Database Management System (DBMS) are not user-friendly. As a result, the majority of Monitors do not effectively utilize computer-based assistance in carrying out their assignment responsibilities.

3. Available computer databases do not contain all of the data elements Monitors need to reference in making assignment decisions.

4. A number of data elements (e.g., education and experience codes) are misleading and not indicative of actual skills and qualifications.

5. Review of data elements is characterized by manual, labor-intensive procedures that are time-consuming and burdensome for Monitors.

6. Extensive redundancy and duplication of effort exists in database maintenance procedures (e.g., updating the Officer Slate File (OSF)) is problematic.

7. Data element accuracy is often questionable and must be verified/corrected by Monitors.

8. Update/modification of the Officer Staffing Goal Model (OSGM) Dictionary is fragmented and excessively time-consuming.

9. Monitors' input to the OSGM Dictionary is often not well considered and reviewed, resulting in staffing goals of questionable validity.

10. Training for Monitors is unacceptable; materials are not tailored for their responsibilities and formal training sessions are not well structured.

Capabilities of the Proposed System

The proposed system will support all existing functional capabilities and provide the following new capabilities to correct deficiencies:

1. Computer-based interactive maintenance of the OSGM Dictionary to be used by Monitors.

2. Development of an Automated Monitor Orientation Subsystem (AMOS) to improve training and orientation of Monitors.

3. User-friendly methods of querying the OADSS database to be based on "Applications Generator" technology. This feature will include a versatile, easy-to-use report generator.

4. Expanded availability of computer-based data elements to include information critical to the assignment process that is not presently readily available.

5. Increased reliability and responsiveness of computer resources supporting MMOA.

6. Computerization of procedures that are currently inefficiently conducted via slow, manual processing.

Scope

The proposed system will be implemented within the MMOA located at HQMC. The mission of MMOA is to administer assignments for all Marine Corps officers (colonels and below) in accordance with regulations, approved assignment policies, and criteria of the CMC. Functions carried out in support of this mission include: issuance of travel orders, classification and reclassification of officers, entering data into the JUMPS/MMS, and assigning officers to career, intermediate, and top level schools. Authority for this mission is contained in numerous MCOs and is summarized in paragraph 2512 of Headquarters, U.S. Marine Corps Order (HQO) P5400.18 Headquarters, U.S. Marine Corps Organizational Manual (HQORGMAN). While MMOA is satisfactorily carrying out its mission, there are several areas that need improvement. One key area of concern is Monitors' input to the OSGM via the Dictionary process. This responsibility is a low priority for them and they frequently "fix" manpower resources resulting in generation of staffing goals that are misleading and of questionable validity. Another area needing improvement is Monitors' review of assignment-relevant data elements. As the present DBMS does not provide user-friendly methods of ad hoc query and report generation, the majority of Monitors use labor-intensive, manual procedures. Increased utilization of computer-based decision aids will make Monitors' jobs easier and allow them more time to interact with constituents, review assignment alternatives, etc. To address the range of deficiencies identified in the earlier Needs Assessment (Chatfield, 1988), the proposed system must be a multi-disciplinary, broad-based effort. Additionally, a modular approach will be used to develop system capabilities to correct cited deficiencies. The focus of OADSS is on integrating existing AISs into a centralized, cohesive system that will provide Monitors with all of the resources needed to effectively carry out the mission of MMOA.

GENERAL DESIGN SPECIFICATION

The New Physical Model, established through prescribed structured analysis techniques, should be sufficient to meet user needs upon implementation. That is, it specifies such system components as ADPE environment, information needs, etc. that are required to accomplish system objectives. Modules (subsystems) of OADSS will be developed on a "prototype" basis and tested on a small-scale before full integration into the MMOA working environment. This will enable the developer to "fine tune" each module by working closely with end users in the subsystem evaluation phase. The operational and functional capabilities of the system will be fully tested in a microcomputer environment before transfer to the MCCDPA, Quantico, mainframe computer. Procurement of a MMOA-dedicated minicomputer to run OADSS and other MMOA models/ systems was initially recommended, however, this was not feasible due to funding and manpower constraints. However, applications software will be selected which are transportable to a minicomputer should this procurement become a reality at some future point. The New Physical Model serves as the basis for development of the GDS as well as the subsequent DDS.

Structured Specification

The Structured Specification presented here is a product of the Structured Analysis approach and it provides a model for both the system under development and all associated documentation. However, it is also useful for the system developer and prospective users alike to communicate system performance requirements. The subsections to follow provide a comprehensive summary of the model developed. Issues related to system components, organizational environment, supporting tools required, and criteria for ensuring internal consistency and completeness will be discussed. The discussion will be limited to the New Physical Model as that is the focus of this technical publication.

Conceptual Model Organization

The physical model developed for the GDS is essentially a refinement of the logical model presented in the earlier FD (Chatfield & Gullett, 1988). That is, each model is composed of three primary components:

1. Data Flow Diagram (DFD)--a network of related mini-systems and the data flows and data stores interfacing those mini-systems.

2. Data Dictionary--a set of definitions of data flows and data stores declared on the DFD.

3. Mini-specification (mini-spec)--a statement of rules governing the transformation of input data flows into output data flows that mini-systems perform at the functional primitive level.

These components are organized in such a manner as to eliminate redundancy in specification of system requirements. That is, the model's organization is structured to reduce complexity by partitioning the model into functional subsystems. This strategy will aid in system development and promote the active participation of users in system design and implementation.

Data Flow Diagram (DFD)

A DFD provides a graphic network of related mini-systems (processors) and all data flows and data stores interfacing with those mini-systems. The following discussion of DFD components is provided to aid the reader in interpretation of the figures which follow:

1. Data Flow--a curved line, or arc, that represents the flow of information or data. Each arc has an arrow (or arrows) indicating direction of the data flow. The name of the data flow is written next to the arc to represent its content.

2. Mini-system (or process)--a circle that represents a transformation of incoming data into outgoing data. The name of the mini-system is written within the circle to describe its function.

3. Data Store--a set of parallel lines used to represent a repository of data. This includes all data stored by the system or accessed by its mini-systems. The name of the data store is written between the parallel lines to summarize its content.

The DFD for OADSS is presented in Figure 1. OADSS is comprised of seven functional mini-systems: five of which are primarily data store-intensive. This orientation is to be expected as OADSS' major emphasis is upon providing improved database query, data retrieval, and reporting procedures to Monitors. The numerous input arcs from mini-systems to the six data stores illustrated make the DFD appear more complex than it actually is, however. The five data store-intensive mini-systems all perform some aspect of the data management process and are necessary to provide MMOA with access to all assignment-related information. The "Provide User Training" mini-system is the only one that operates in essentially a stand-alone mode. While many of its lessons will mirror DBMS utilization (via OADSS), only sample databases will be used.

Context Diagram

The context diagram, also referred to as the relative context diagram, provides a top-level graphic representation of the system. While the diagram depicts all net inputs to and net outputs from the system, no partitioning of the system components is included. The context diagram is composed of the following:

1. Net Data Flow--a curved line, or arc, that represents the net flow of information into or out of the system. Each arc has an arrow (or arrows) indicating direction of the net data flow. The name of the net data flow is written next to the arc to represent its content.

2. System--a circle that represents the entire system, or subsystem, under development. The name of the system is written within the circle.

3. Source/Destination--a rectangle that represents a source or destination for respective system inputs and outputs. The name of the source/destination is written within the rectangle.

The context diagram for OADSS is presented in Figure 2. Four specific organizational entities (or activities) will interface with the system for input/output purposes. The first, MMOA, is the primary system user. MMOA's input will consist of data element updates and various processing requests (e.g., ad hoc query). System output to MMOA will include ad hoc query feedback, reports,

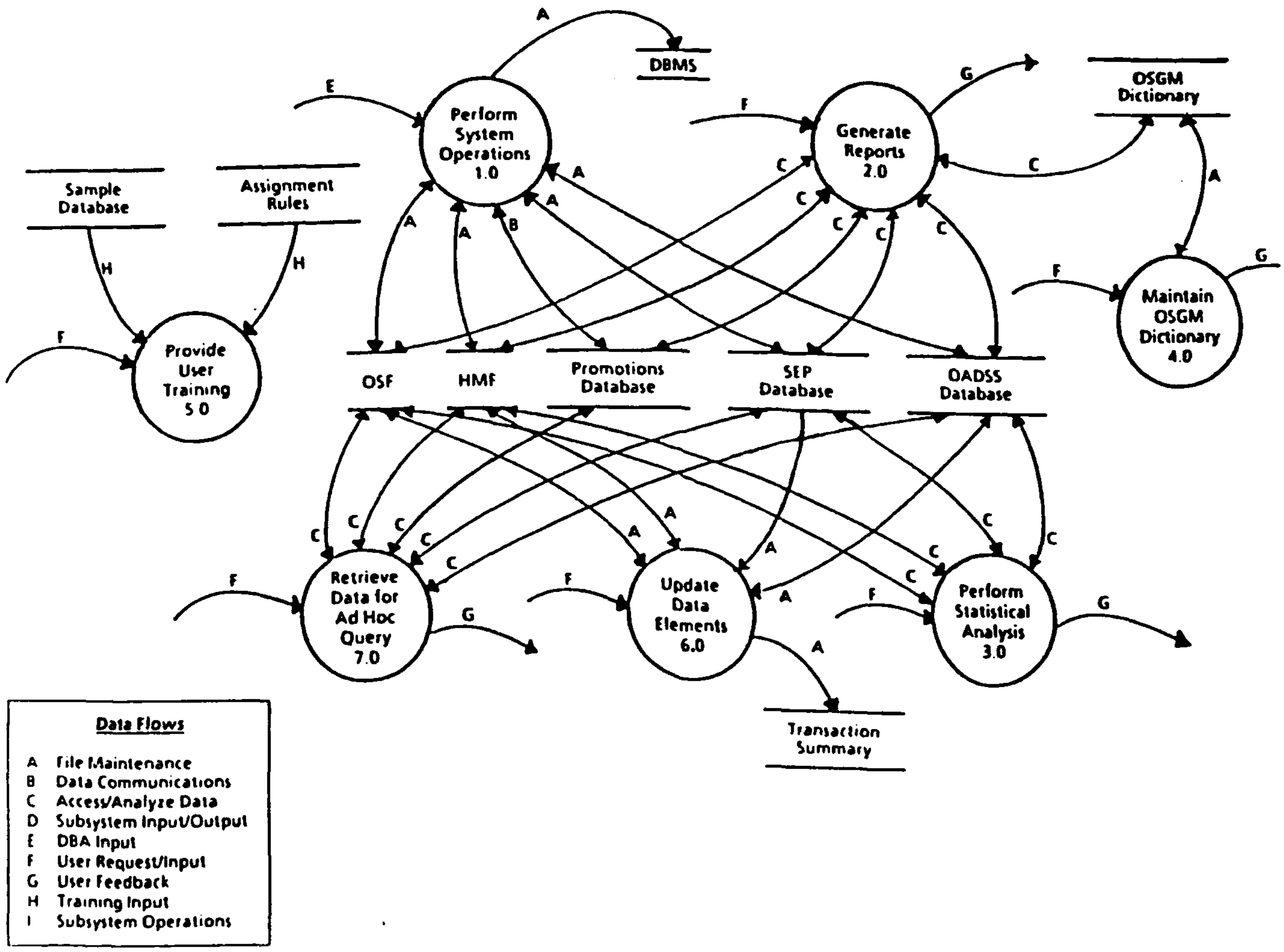

Figure 1. Data flow diagram (DFD).

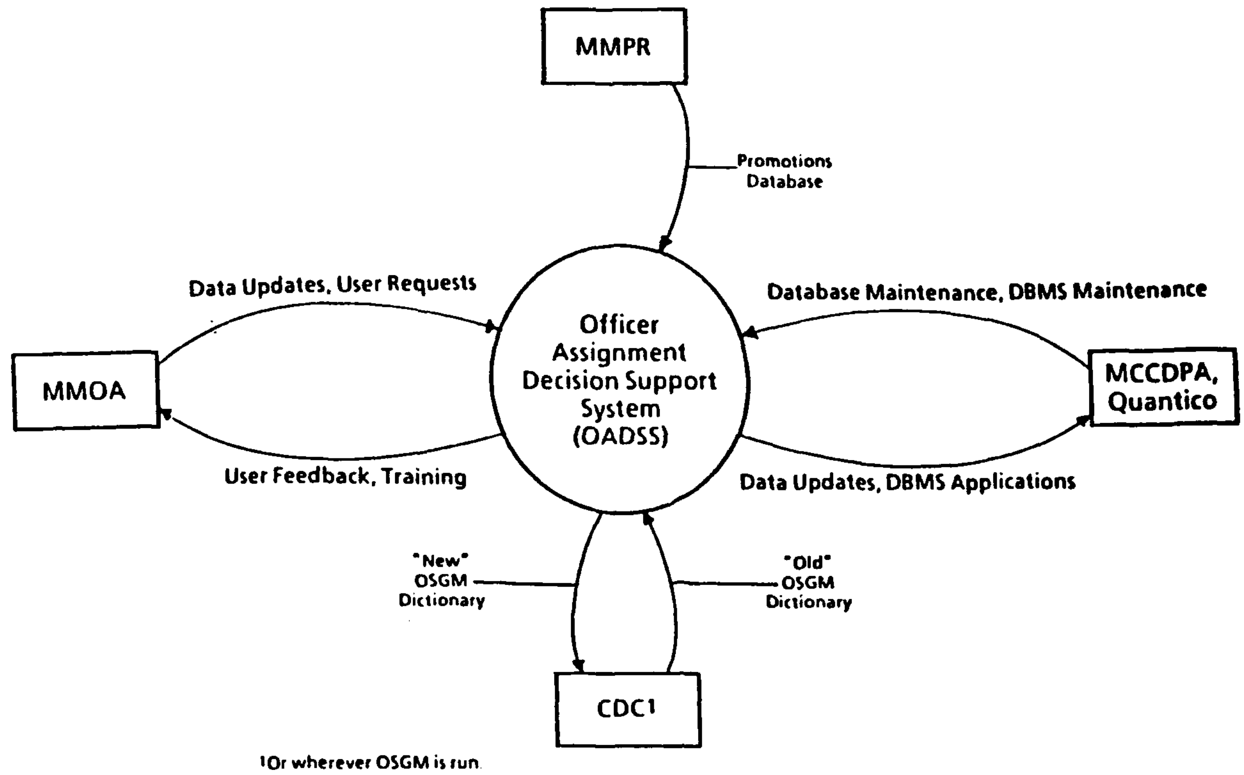

Figure 2. Context diagram.

and training sessions. The second interface with OADSS, by the Manpower Management Promotions Branch (MMPR), is represented by input in the form of the promotions database. The third and most critical system interface is with the MCCDPA, Quantico. As OADSS will operate in a mainframe environment, MCCDPA input includes maintenance of databases (HMF, OSF, etc.) and DBMS files. System output to the MCCDPA consists of updated data elements, system security, and DBMS applications programs. The assumption is that the MMOA Database Administrator (DBA) and the MCCDPA DBA will work closely together to operate and maintain OADSS. The fourth and final system interface will be with the organization responsible for running the OSGM; currently Control Data Corporation (CDC). System input from this source will be the "old" (from a previous OSGM run) OSGM Dictionary. Modifications will be made to the Dictionary via interactive update procedures and the system will output the "new" Dictionary to CDC. A close working relationship must be maintained between MMOA and the other three organizational entities for system implementation to be successful.

Leveled Set of Data Flow Diagram Components

A "leveled set" of DFDs graphically represents the proposed system by partitioning it into functionally primitive mini-systems or processes. A complete set of leveled DFDs is composed of the following:

1. Context Diagram or Relative Context Diagram--this is the extreme top-level graphic representation of the system or subsystem under study and appears as Figure 2.

2. Figure 0--this is a graphic representation of the next level down from the Context Diagram and reflects a high level partitioning of the system. Each mini-system or process declared on the figure is assigned a number (starting with 1) but this is simply a reference point and not reflective of an ordered sequence.

3. Child Diagrams--this is a graphic representation of yet a lower level in that partitioning of the parent mini-system from the previous level is accomplished. Each child diagram figure name and figure number will be that of its parent mini-system. Each mini-system declared on the child figure is assigned the number of the figure number, a decimal point, and a unique local number (starting with 1). Refer to Appendix B to review the content of each child diagram.

To reiterate, the leveled set is comprised of a Context Diagram (Level 0), Figure 0 (Level 1), and Child Diagrams (Level 2). The system becomes more "decomposed" at each level in the hierarchy, thus providing an excellent summary of relationships among mini-systems.

Figure 0

Figure 0 (Level 1) is presented in Figure 3 and illustrates the seven mini-systems (processes) displayed earlier on the DFD (Figure 1). Labels provided on the input/output arcs clearly describe the nature of interaction between OADSS and the respective mini-systems. The system is extremely user-oriented as the mini-systems are directed towards providing process-dependent feedback to user demands. By this partitioning into mini-systems, the operational capabilities of OADSS are clearly and concisely defined.

Child Diagrams

Child diagrams (Level 2) for the seven mini-systems are presented in Figures B-1 through B-7 of Appendix B. These figures partition the respective mini-systems into their component parts. To better understand these processes, a brief description of components is provided below for each mini-system.

System Operations Subsystem (Figure B-1)--this subsystem will be accessed only by the DBAs at the MCCDPA and in MMOA to carry out the "housekeeping chores" for the system. The five components of the subsystem are: (1) system security, (2) database maintenance, (3) telecommunications, (4) system backup, and (5) DBMS maintenance. The DBAs will be responsible for all such system maintenance and interface considerations; all of which should be transparent to users.

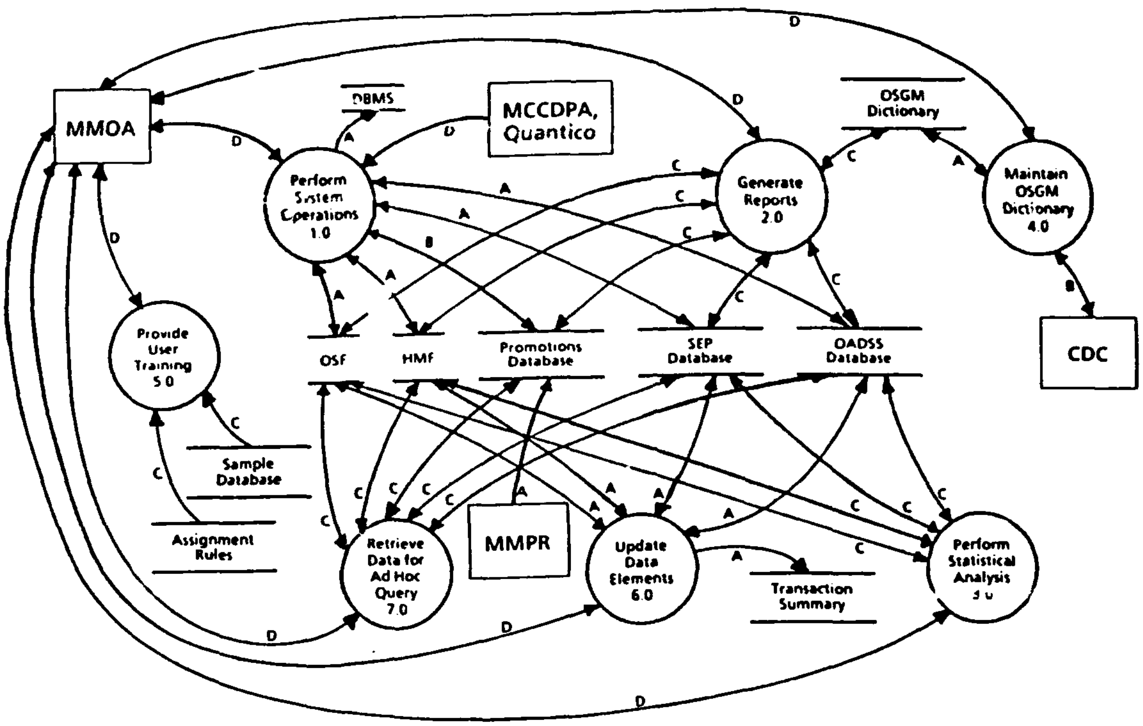

Figure 3. Level 1: Figure 0 of the leveled set.

Report Generation Subsystem (Figure B-2)--this subsystem will be used to generate reports based on user-specified criteria. This includes formalized management reports as well as informal, need-specific queries. The key factor is utilization of the DBMS Applications Generator. This processor will "build" (including criteria selection and output format) the report request without requiring the user to have expertise in the DBMS programming language. The five components of the subsystem are: (1) DBMS Applications Generator, (2) access database, (3) format report, (4) designate action/output mode, and (5) print report.

Statistical Analysis Subsystem (Figure B-3)--this subsystem is designed to perform statistical calculations required to conduct assignment procedures. As statistics required typically involve standard analyses, the statistical functions of the DBMS are satisfactory. As with the previous subsystem, the DBMS Applications Generator will be used to produce processing requests. The five components of this subsystem are: (1) DBMS Applications Generator, (2) access database, (3) perform calculations, (4) designate action/output mode, and (5) print results.

Data Element Update Subsystem (Figure B-4)--this subsystem provides an on-line facility for users to update OADSS databases. As personnel information is highly dynamic, it is essential that the database is as current and as accurate as possible. The seven components of the subsystem are: (1) access database, (2) add data, (3) delete data, (4) update data (for existing data), (5) data verification/rules, (6) modify database, and (7) transaction summary. The last component provides users with a DBMS-generated summary of how many attempted changes were accepted or rejected.

User Training Subsystem (Figure B-5)--this subsystem provides a variety of Monitor-oriented, computer-based training sessions in a stand-alone environment (microcomputer). User interaction will be stressed and additional training sessions "lessons" will likely be added after system implementation. The five components of the subsystem are: (1) select training session, (2) conduct training session, (3) access sample database, (4) access DBMS, and (5) user interaction.

Ad Hoc Query Subsystem (Figure B-6)--this subsystem provides users with fast, easy access to assignment-related data elements in the OADSS database and is the heart of the proposed system. The DBMS Applications Generator will enable users to execute even complex queries without requiring experience with DBMS language and syntax. This capability will promote effective utilization of computer resources and will substantially reduce the "clerical" workload of Monitors. The five components of the subsystem are: (1) DBMS Applications Generator, (2) access database, (3) format output, (4) designate action/output mode, and (5) print query results.

OSGM Dictionary Maintenance Subsystem (Figure B-7)--this subsystem will provide a means for Monitors to interactively maintain their portion of the OSGM Dictionary. Such a capability will encourage active participation by Monitors, reduce input errors, and reduce work demands on the OSGM Officer. The eight components of the subsystem are: (1) Select Maintenance Procedure, (2) access OSGM Dictionary, (3) add records, (4) delete records, (5) update records, (6) data verification/rules, (7) modify OSGM Dictionary, and (8) print records.

Figure 4 provides a graphic summary of the relationship between the seven subsystems discussed above and the six system modules presented in the FD (Chatfield & Gullett, 1989). As is readily apparent, several of the subsystems interact with virtually all of the modules (e.g., Perform System Operations on all but the AMOS). In contrast, OSGM Dictionary Maintenance and User Training are very modular-specific. From a summary standpoint, the information conveyed in Figure 4 reflects the scope of each of the OADSS subsystems.

Mini-specification

A mini-specification (mini-spec) is a statement of the logical requirements governing the transformation of input data flows into output data flows at the functionally primitive mini-system, or process level. While drafting of mini-specs is a valuable design aid, it is not appropriate for OADSS because the subsystems are not declared at the lowest level. That is, the subsystems are often inextricably tied to the functionality of the DBMS. Because of this, it is not feasible to partition the proposed system to a level where delineation of mini-specs is possible. Subsystems will include applications generation, data verification, and several other functions that are relatively complex. And, as these capabilities are actually a component of the DBMS, it is not necessary to provide a design for mini-specs.

Information Modeling

This section describes the product of an approach to modeling essential memory known as entity-relationship analysis; the Entity-relationship Diagram (ERD). Figure 5 displays the ERD, providing a graphic summary of entities needed in essential memory as well as illustrating the relationships among them. All of the entities in the ERD were previously discussed in the FD (Chatfield & Gullett, 1988) and DRD (Chatfield & Gullett, 1990). However, the ERD is valuable

Subsystem	Module: SEP Coordinator Database	OSGM Dictionary Maintenance	Officer Promotion Database	Annual Slate Letters and Monitor Notes	Improved Database Access	Automated Monitor Orientation Subsystem
Perform System Operations	✓	✓	✓	✓	✓	
Generate Reports	✓	✓		✓	✓	✓
Perform Statistical Analysis	✓			✓	✓	✓
Retrieve Data for Ad Hoc Query	✓		✓	✓	✓	✓
Maintain OSGM Dictionary		✓				✓
Provide User Training						✓
Update Data Elements	✓	✓		✓	✓	✓

Figure 4. Summary of relationship between officer assignment decision support system (OADSS) subsystems and modules.

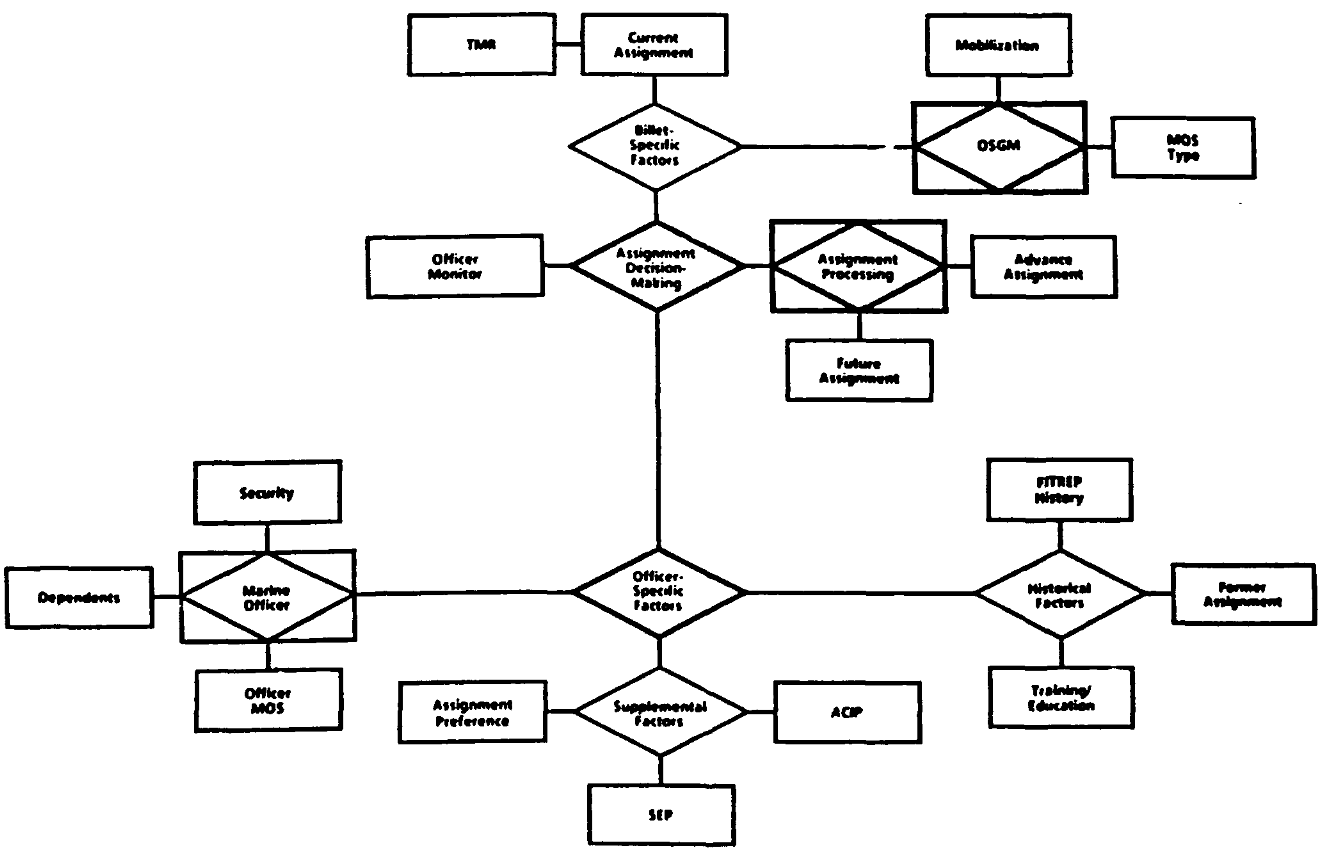

Figure 5. Entity-relationship diagram (ERD).

for identifying the capabilities of the New Logical Model (see funtional description (FD)) to meet user informational needs. Thus, issues concerning data entity relationships can be raised by reviewing the ERD. Information conveyed in the Data Dictionary (Appendix B of the requirements document (RD)) is of course the starting point for derivation of the ERD. The Data Dictionary summarizes all data elements stored by the Logical Model to accomplish system capabilities. Normally, mini-specifications are used to provide inter-object (i.e., entity) relationships. However, this was not realistic for the proposed system due to DBMS interfaces. Therefore, the ERD is based principally upon the Data Model Diagram and the New Physical Model. The entity-relationship model was derived by partitioning elements in the Data Dictionary into homogeneous entities. Then, each entity was given a name that described the criteria for grouping the elements together. For example, the Security Entity contains only three data elements (level of security clearance, date of security clearance, and type of security investigation), all of which provide information about an officer's security clearance. Once this has been accomplished, the ERD can be established as a means of summarizing relationships among entities. The ERD has two basic components:

1. Entity--an object, or store of data. Each entity is represented on the ERD as a box.

2. Relationship--a set of connections that relate two or more entities. Each relationship is represented on the ERD as a diamond. In the instance where a relationship also represents an entity, it is represented as a box with a diamond superimposed.

Referring to Figure 5, the central relationship is between the Officer Monitor and Assignment Processing entities. This relationship is labeled "Assignment Decision-making" and incorporates the plethora of data elements that influence a Monitor's assignment decisions. Because of the complexity of the ERD, the information below is provided to summarize the relationships among entities and how each relationship is tied to "Assignment Decision-making." The linking of relationships to this focal relationship for the system is referred to as the "path."

Relationship/Path	Entities
Marine Officer via Officer-Specific Factors	Security Dependents Officer MOS
Supplemental Factors via Officer-Specific Factors	Assignment Preference Special Education Program (SEP) Aviation Career Incentive Pay (ACIP)
Historical Factors via Officer-Specific Factors	Fitness Report of Officers (FITREP) History Former Assignment Training/Education
OSGM via Billet-Specific Factors	Mobilization MOS Type
Current Assignment via Billet-Specific Factors	Table of Manpower Requirements (TMR)
Officer Monitor	N/A
Assignment Processing	Advance Assignment Future Assignment

The names of the relationships are self-explanatory for identifying why particular entities were grouped together. However, it should be noted that the following entities (data stores) were also used to denote relationships: (1) OSGM, (2) assignment processing, and (3) marine officer. For more specific information about the content of data stores, refer to the FD and RD documents.

Organizational Context

OADSS will operate within MMOA located at HQMC. The Director, Personnel Management Division (MM), under the direction of the Deputy Chief of Staff for Manpower, is responsible for administration and retention of officer and enlisted Marine Corps personnel; and distribution, appointment, promotion, retirement, and discharge of commissioned officers, warrant officers, and enlisted personnel. Within this purview, MMOA is specifically responsible for administering the assignment and classification of all Marine Corps officers (colonel and below). Figure 6 illustrates the organizational structure of MMOA. MMOA is comprised of five sections, two of which essentially provide support services for officer Monitors. The sections within MMOA and their primary responsibilities are outlined below.

Section	Responsibility
MMOA-1	Ground Officer Assignment
MMOA-2	Aviation and Aviation/Ground Officer Assignment
MMOA-3	Plans, Policy, Systems, and Special Programs
MMOA-4	Aviation and Ground Colonel Assignment
Administrative	Administrative Service for Branch

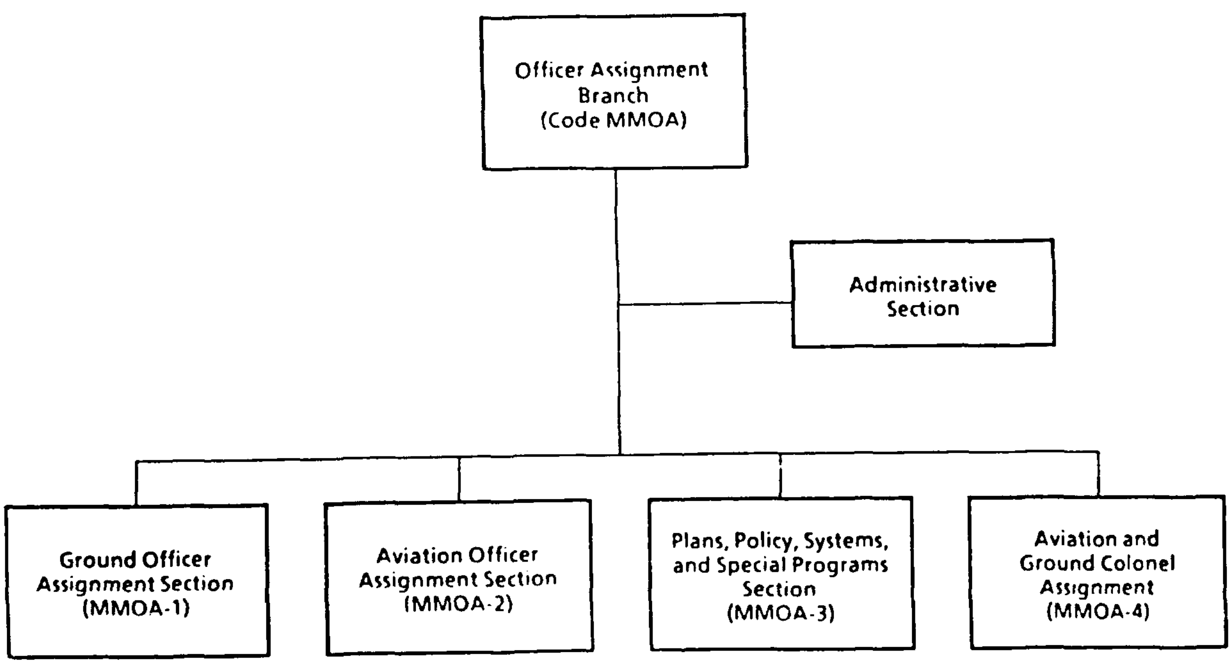

Figure 6. Organization of the officer assignment branch (MMOA).

Sections MMOA-1, MMOA-2, and MMOA-4 are responsible for the actual assignment of officers within their respective populations (indicated by Monitor Activity Code (MAC)). MMOA-3 coordinates administration of the SEP, lateral MOS moves, and retention and release matters. MMOA-3 (Systems), formerly MMOA-5 (Operations Analysis and Systems Support), coordinates running the OSGM and provides a wide range of analysis and programming support for the other MMOA sections. While a full discussion of all MMOA responsibilities is well beyond the scope of this document, the primary assignment-related functions are presented below:

1. Effects and monitors assignment of all officers (LtCol and below).

2. Issues travel orders for officers in accordance with approved policies, laws, and fiscal/travel regulations.

3. Administers delay in route leave between duty stations.

4. Classifies/reclassifies officers.

5. Enters personnel data into appropriate data files (e.g., OSF, MMS).

6. Assigns officers to professional education schools while following established assignment policies.

7. Assigns officers to military schools in conjunction with the Deputy Chief of Staff for Training and occupational field sponsors.

In carrying out officer assignment responsibilities, MMOA is supported by several organizational entities which maintain databases accessed by officer Monitors. For example, the Fitness Report Section (MMOS-2) of the Operations and Support Branch (MMOS) is responsible for processing and distributing FITREPS. Master Brief Sheets are also a product of MMOS. On a larger scale, JUMPS/MMS is maintained by the MCCDPA, Kansas City, and the HMF by the MCCDPA, Quantico. Overall, Automated Data Processing (ADP) support of MMOA is handled by the MCCDPA, Quantico. This support includes centralized file maintenance, access to the AMDAHL mainframe computer, and coordinating data communications between HQMC and the MCCDPA. As discussed earlier, successful implementation of OADSS is contingent upon close cooperation between MMOA and the MCCDPA, Quantico; particularly at the DBA level.

Automated Data Processing Equipment (ADDPE) Environment

The recommended operational environment for the proposed system is the AMDAHL mainframe environment at the MCCDPA, Quantico. As discussed in the Feasibility Study (Chatfield & Gullett, 1989), the ideal ADPE for OADSS would be a MMOA-dedicated minicomputer to ensure rapid system response. However, MMOA manning constraints and an inability to procure such equipment within the OADSS project time frame precludes further pursuing this alternative. Although it was not initially the recommended alternative, the mainframe environment should be suitable for system implementation as recent major upgrades have significantly reduced system response time decrement. This section presents the ADP environment in which OADSS will operate as well as an overview for transitioning from microcomputer-based prototypes to a fully operational mainframe-based system. Both equipment requirements within the MCCDPA, Quantico, and MMOA will be addressed.

Marine Corps Central Design and Programming Activity (MCCDPA), Quantico

The operating environment at the MCCDPA is configured to provide large-scale data processing support to a number of Marine Corps organizations. The MCCDPA, Quantico provides services to: HQMC; Marine Corps staff agencies; the Marine Corps Development and Education Command (MCDEC); the Computer Sciences School; and several other Marine Corps facilities located in the Washington, DC area. The following subsections discuss various components of the ADP environment.

1. **Processors.** The MCCDPA operates two AMDAHL 470/V8 mainframe computers in a coupled configuration to support both batch and on-line processing. The AMDAHL 470 machine is compatible with International Business Machines (IBM) equipment and has an architecture similar to that of the IBM 370. Each processor contains 16 megabyte (MB) of real memory.

2. **Storage.** A variety of storage media and devices are currently available within the MCCDPA. Strings of IBM 3380 disk storage devices (single-density) provide direct access storage. In addition, magnetic tape storage is available for off-line storage and backup of the direct access devices. Storage Technology Corporation (STC) 3650 and 3670 tape drives provide both 7-track and 9-track tape storage capabilities.

3. **Input/Output Devices.** A number of input/output devices are available to users. This list of devices includes card readers, card punches, line/laser printers, and microfiche production equipment.

4. **Communications.** Communications with the AMDAHL mainframe environment is controlled via COMTEN communications processors. Specifically, a COMTEN 3690 is attached to each 470/V8 for communications purposes. Communication between HQMC and the MCCDPA is provided by three dedicated communications lines, each with a peak transmission rate of 50 kilobyte (KB). These transmission lines are part of the Marine Corps Data Network (MCDN) which provides communications with other Marine Corps sites. The transmission rate of the MCDN ranges from 1200 bits to 19.2 KB per second.

Officer Assignment Branch (MMOA)

As discussed earlier, OADSS modules (subsystems) will be developed on a prototype basis in a microcomputer environment. Two complete microcomputer systems will be added to MMOA and will satisfy, at a minimum, the following requirements:

1. IBM compatibility
2. 640 KB RAM
3. 20 MB hard disk
4. High resolution monochrome monitor
5. One 360 MB floppy drive
6. Graphics capability
7. Dot matrix printer

In addition to the above requirements, one of the systems will include a 1200 baud modem while the other will include a terminal emulation board (e.g., IRMA Board). This equipment is needed to transfer data within HQMC and between HQMC and the MCCDPA, Quantico. In addition, the modem-equipped system will include approximately 60 MB of auxiliary storage to handle large databases. Figures 7 through 12 illustrate the proposed hardware/software configuration for each OADSS module. A large box is used to denote hardware while a smaller, attached box indicates the software to be used. Communications between ADPE environments are illustrated with solid lines; arrows indicate the direction of data flows. Both the prototype and transition configuration are presented for each module to comprehensively detail ADPE considerations. However, as the AMOS will operate in strictly a microcomputer environment it has no transition period.

Software Environment

Mainframe-based software required to support the proposed system is all currently in place. The Multiple Virtual Storage (MVS) operating system will continue to control system operations and activities. The Advanced Communications Facility/Virtual Telecommunications Access Method (ACF/VTAM) package provides control of all on-line processing. OADSS databases and ad hoc query functions will largely migrate from the Adaptable Database System (ADABAS) NATURAL DBMS to the FOCUS DBMS. This transition is necessitated by the fact that FOCUS is much more user friendly thanks principally to its TABLETALK implementation of Applications Generator technology. However, FOCUS is capable of reading ADABAS files and thus this may eliminate the need to actually transfer large databases to FOCUS format. Microcomputer software will include the PC/FOCUS DBMS, the R:base 5000 DBMS, AutoMentor, and Cross-talk XVI. PC/FOCUS will be used to develop most applications programs in OADSS; all of which will be completely transportable to mainframe FOCUS. R:base 5000 is currently used extensively within MMOA-3 and some consideration is being given to using it rather than PC/FOCUS for the OSGM Interactive Maintenance module. AutoMentor (or similar tutoring software) will be used to develop lessons for the AMOS module. Finally, Crosstalk XVI will be used for modem communications.

New Performance Characteristics

Implementation of the proposed system will allow Monitors to provide significantly better "customer service" to constituents. That is, improved system response time and user-friendly ad hoc query capabilities will enable Monitors to provide constituents with very rapid, timely feedback to assignment-related questions and concerns. In addition, OADSS will dramatically reduce the "clerical" workload of Monitors by replacing present manual, labor-intensive processing with automated procedures. However, due to the nature of the assignment process, it is impossible to state precisely how long a Monitor will spend using the system to make an assignment. In reality, the review of data elements, interaction with constituents, and other related activities are often spread over several weeks and are non-sequential. A conservative estimate is that implementation of OADSS will reduce the "throughput" time for each assignment by 50 percent.

Monitors will access the system primarily to identify constituents meeting selected criteria (e.g., MOS, paygrade, educational background). Response time to such queries will depend on several factors; among them are response time of the AMDAHL (typically moderated by the

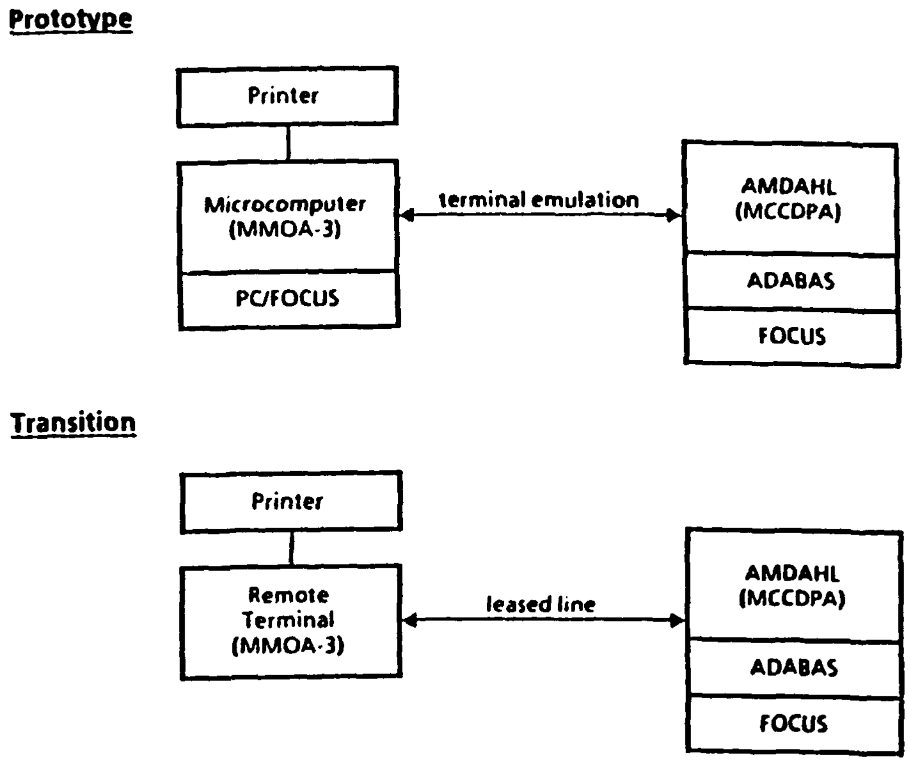

Figure 7. Special education program (SEP) administration module.

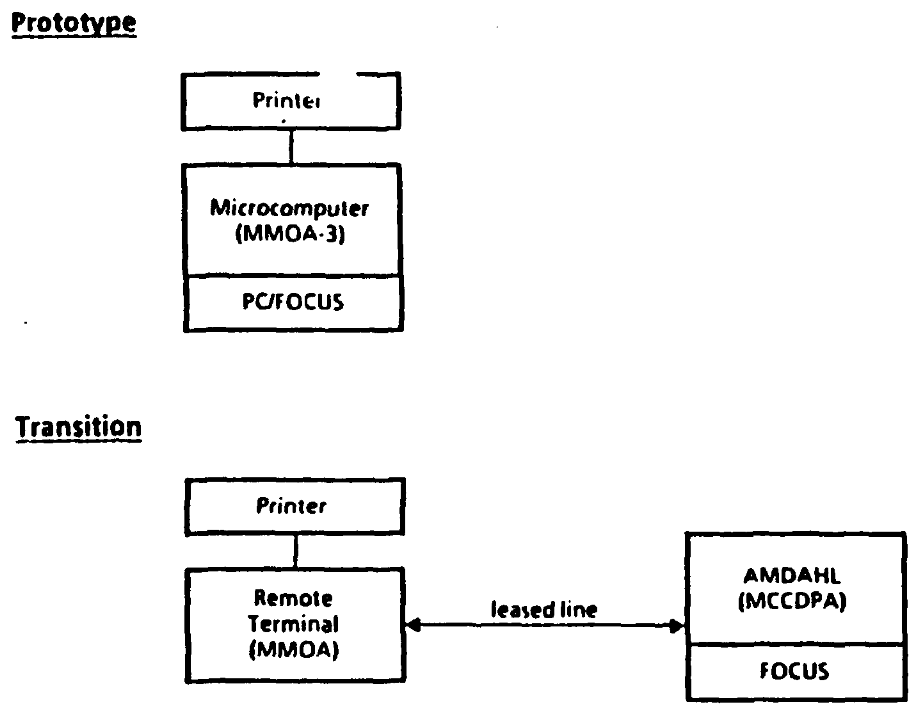

Figure 8. Annual slate letters/monitor notes module.

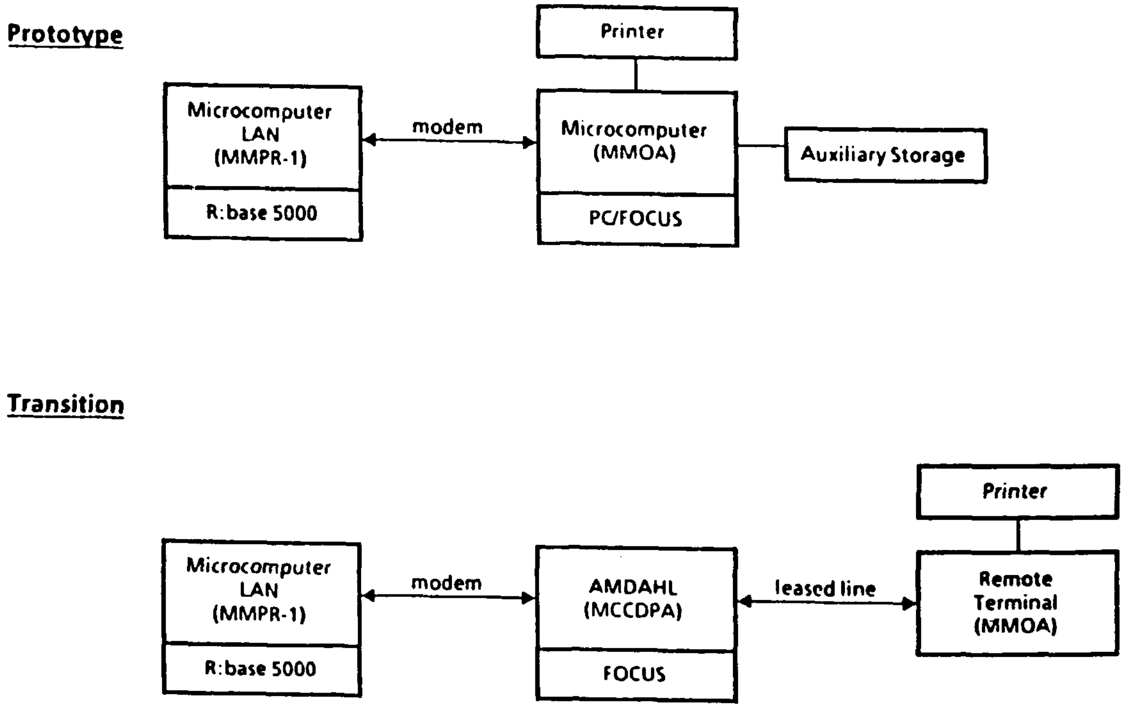

Figure 9. Officer promotion database module.

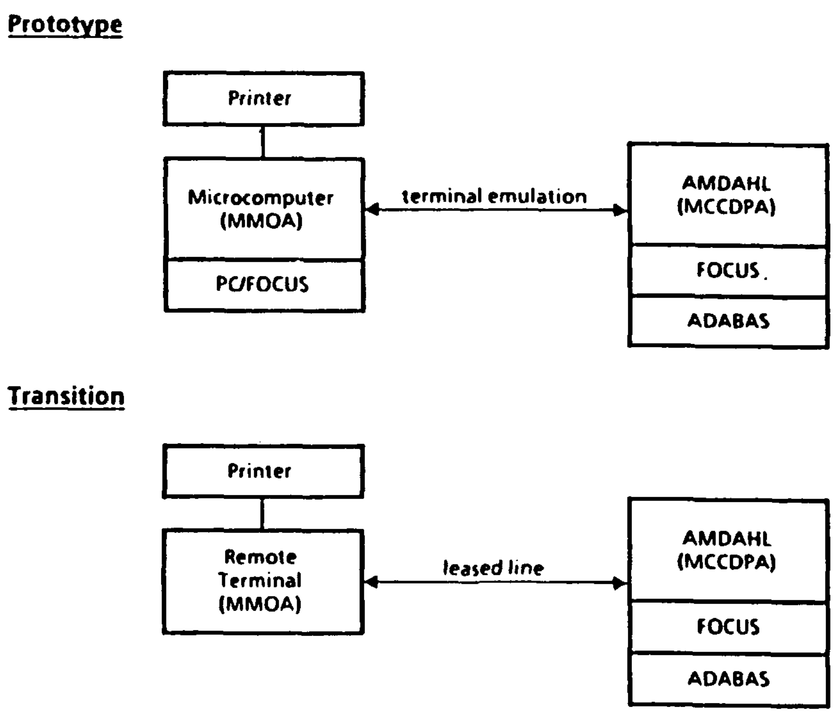

Figure 10. Improved database access module.

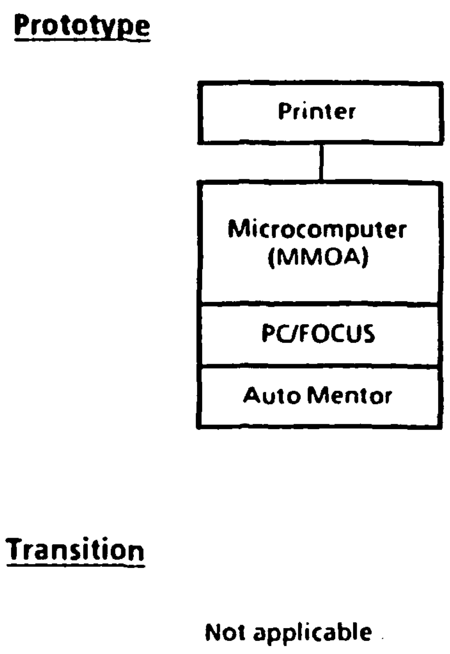

Figure 11. Automated monitor orientation subsystem (AMOS) module.

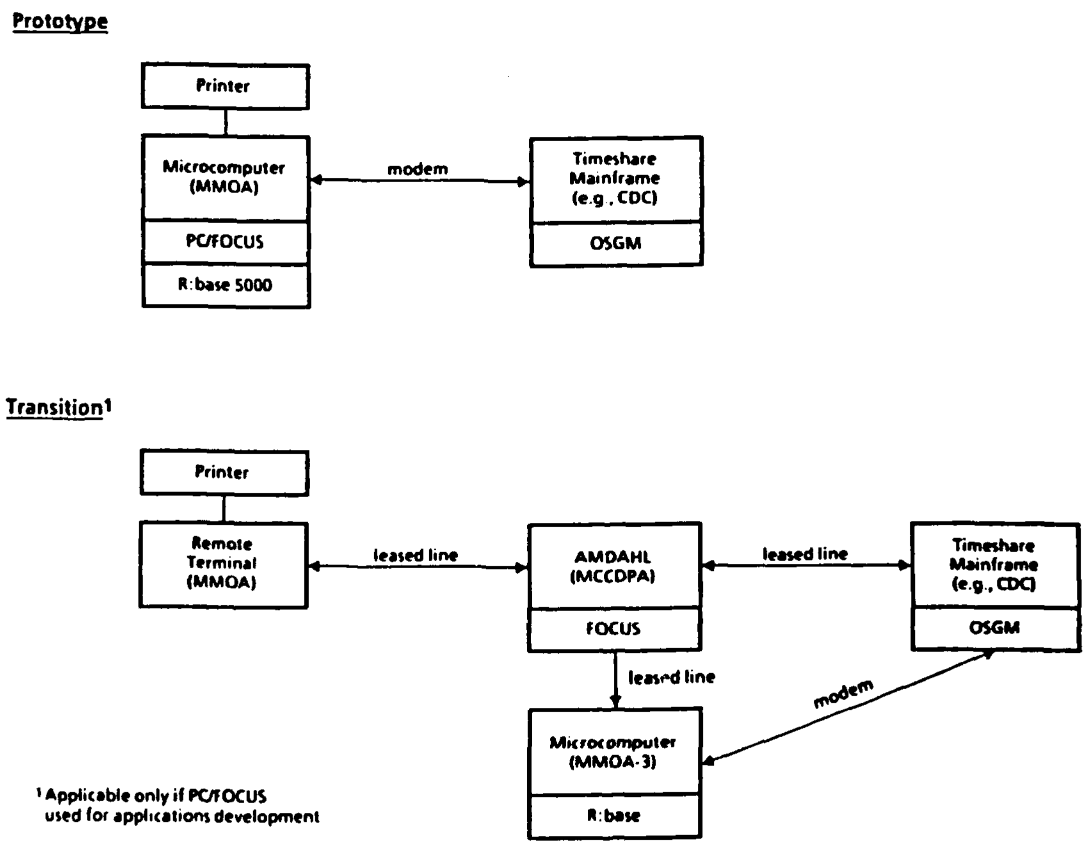

Figure 12. Officer staffing goal model (OSGM) interactive maintenance module.

number of concurrent on-line users), type of query (large sorts are very demaning on the central processing unit (CPU)), location and layout of database accessed, user's priority level, and processing efficiency of the query. Therefore, while an accurate estimate of response time cannot be established, it is projected that queries of medium complexity (selection on four or five criteria) will be completed in 1-3 minutes. Updates of data elements will be processed much faster, requiring only 5-10 seconds to complete. System response time decrement under periods of heavy usage is anticipated. The volume of throughput will vary among Monitors as the number of constituents for each ranges from approximately 240-2000. Obviously, those Monitors with larger populations will utilize the system to a greater extent than their peers. It is important to reiterate that system functions are not sequential and the modular approach allows access to a subsystem at any time via the OADSS main menu.

Information Requirements

This paragraph summarizes information requirements of the New Physical Model in terms of transaction inputs and outputs. These information requirements, which can be divided into five specific areas, are discussed below.

1. *Add, Delete, Edit Data.* Maintenance of data elements is critical to keeping information up-to-date and accurate. Hence, a primary "input" to the system will be addition, deletion, and editing of resident data elements. This will be accomplished using menu-driven procedures and easy-to-use "screen forms."

2. *Database Query and Retrieval.* The primary requirement for OADSS is that it provide Monitors with powerful, yet easy-to-use ad hoc query and data retrieval capabilities. Ad hoc query will allow a Monitor to specify criteria for identifying candidate officers to fill a billet. For example, the Monitor may wish to identify all individuals that have a MOS of 9612, are not married, and have a preference for assignment in the Fleet Marine Force (FMF) on the west coast. By using OADSS to review a wide scope of pertinent information, Monitors will free themselves from the slow, laborious, manual methods now used. The DBMS Applications Generator will be employed as a front-end processor so that queries and retrievals are automatically formatted to be phrased in the proper language and syntax. In addition to ad hoc query, records for individual officers will be able to be retrieved.

3 *Print Reports.* The primary "output" of the system will be feedback to ad hoc query requests. Typically, these "reports" will be viewed on the Video Display Terminal (VDT) screen. Then, if the user requests, the report can be printed in a specified format. Once again, the DBMS Applications Generator will be used to format the request for report output.

4. *Statistical Analysis.* The results from statistical analyses will also be an important system output. While statistical analysis will typically be limited to simple descriptive statistics (frequency counts, averages, etc.), access to more advanced analyses such as multiple regression will also be available. Again, the DBMS Applications Generator will be utilized to provide a user-friendly interface between Monitors and DBMS language and syntax.

5. *Menu Selection.* The final input to the system will be users' selections from menus provided. The OADSS main menu will be used to access system modules while module sub-menus will be used to carry out actual applications. The proposed system will be menu-driven to the greatest extent possible to facilitate ease-of-use.

RECOMMENDATIONS

1. A Detailed Design Specification (DDS) should be completed by the system designer (i.e., NPRDC) as the next step in the "definition and design" phase of system development.

2. In concert with the modular approach to system development, "rapid prototyping" should be used as a means of minimizing system development time and ensuring the active participation of end users.

APPENDIX A
TERMS AND ABBREVIATIONS

TERMS AND ABBREVIATIONS

ACF/VTAM	Advanced Communications Facility/Virtual Telecommunications Access Method
ACIP	Aviation Career Incentive Pay
ADABAS	Adaptable Data Base System
ADP	Automated Data Processing
ADPE	Automated Data Processing Equipment
ACS	Automated Data System
AIS	Automated Information Systems
CDC	Control Data Corporation
CMC	Commandant of the Marine Corps
DBA	Data Base Administrator
DBMS	Data Base Management System
DFASC	Deployable Force Automated Service Center
DFD	Data Flow Diagram
DoD	Department of Defense
DRD	Data Requirements Document
DSS	Decision Support System
ERD	Entity-Relationship Diagram
FD	Functional Description
FITREP	Fitness Report of Officers
FMF	Fleet Marine Force
GDS	General Design Specification
HMF	Headquarters Master File
HQMC	Headquarters, U.S. Marine Corps
HQO	Headquarters, U.S. Marine Corps Order
HQORGMAN	Headquarters, U.S. Marine Corps Organization Manual
JUMPS/MMS	Joint Uniform Military Pay System/Manpower Management System
KB	Kilobyte
LCM	Life Cycle Management
LCM-AIS	Life Cycle Management of Automated Information Systems

MB	Megabyte
MCCDPA	Marine Corps Central Design and Programming Activity
MCDEC	Marine Corps Development and Education Command
MCDN	Marine Corps Data Network
MCO	Marine Corps Order
MMOA	Code for Officer Assignment Branch
MMOS	Code for Operations and Support Branch
MMPR	Code for Promotions Branch
MMS	Manpower Management System
MOS	Military Occupational Specially
MPI	Code for Manpower Management Information Systems Branch
MVS	Multiple Virtual Storage
OADSS	Officer Assignment Decision Support System
OSF	Officer Slate File
OSGM	Officer Staffing Goal Model
PCS	Permanent Change of Station
PREPAS	Precise Personnel Assignment System
RASC	Regional Automated Service Center
REMMPS	Reserve Military Manpower Pay System
STC	Storage Technology Corporation
TMR	Table of Manpower Requirements
USMC	United States Marine Corps
VDT	Video Display Terminal

APPENDIX B
CHILD DIAGRAMS

Symbol	Data Flow
A	File Maintenance
B	Data Communications
C	Access/Analyze Data
D	Sub-system Input/Output
E	DBA Input
F	User Request/Input
G	User Feedback
H	Training Input
I	Sub-system Operations

Figure B-1. Legend for interpreting child diagram data flows.

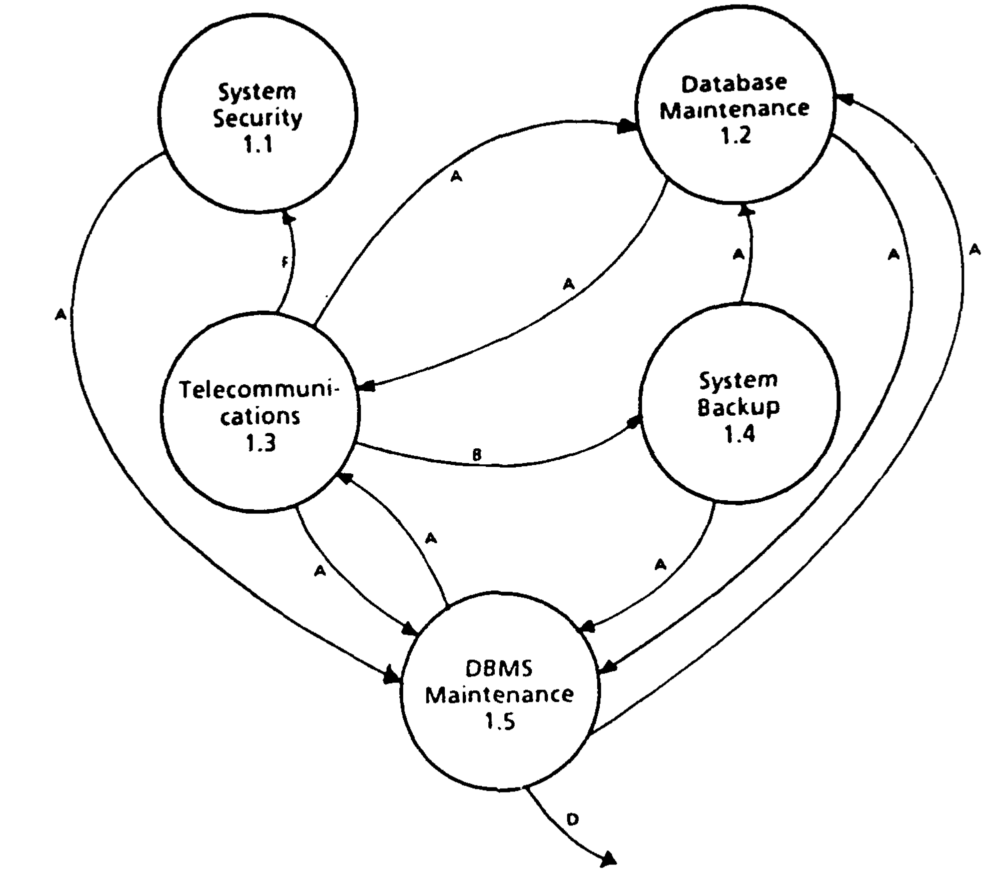

Figure B-1. Level 2: System operations subsystem.

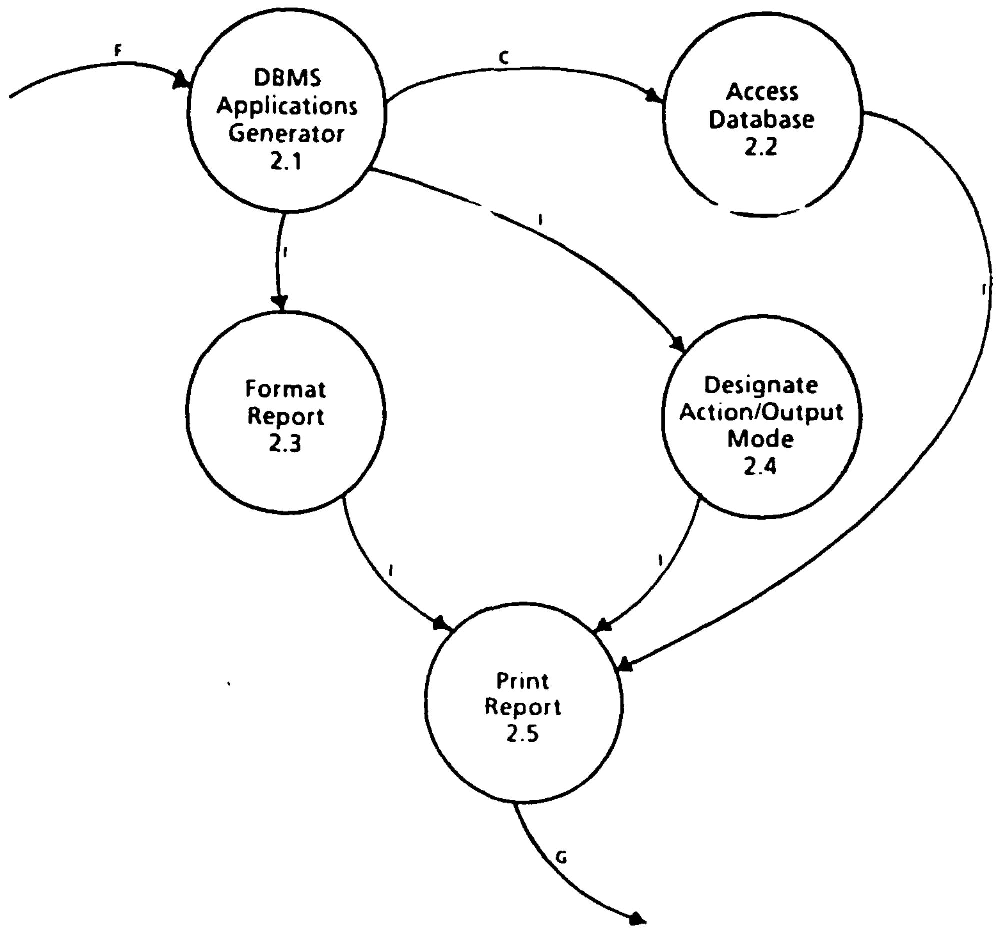

Figure B-2. Level 2: Report generation subsystem.

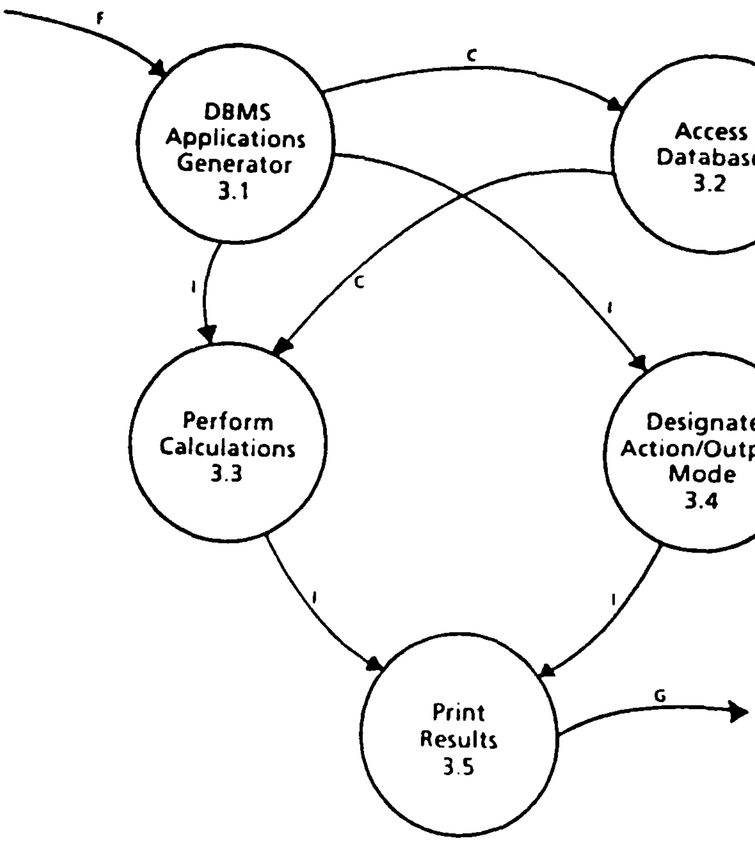

Figure B-3. Level 2: Statistical analysis subsystem.

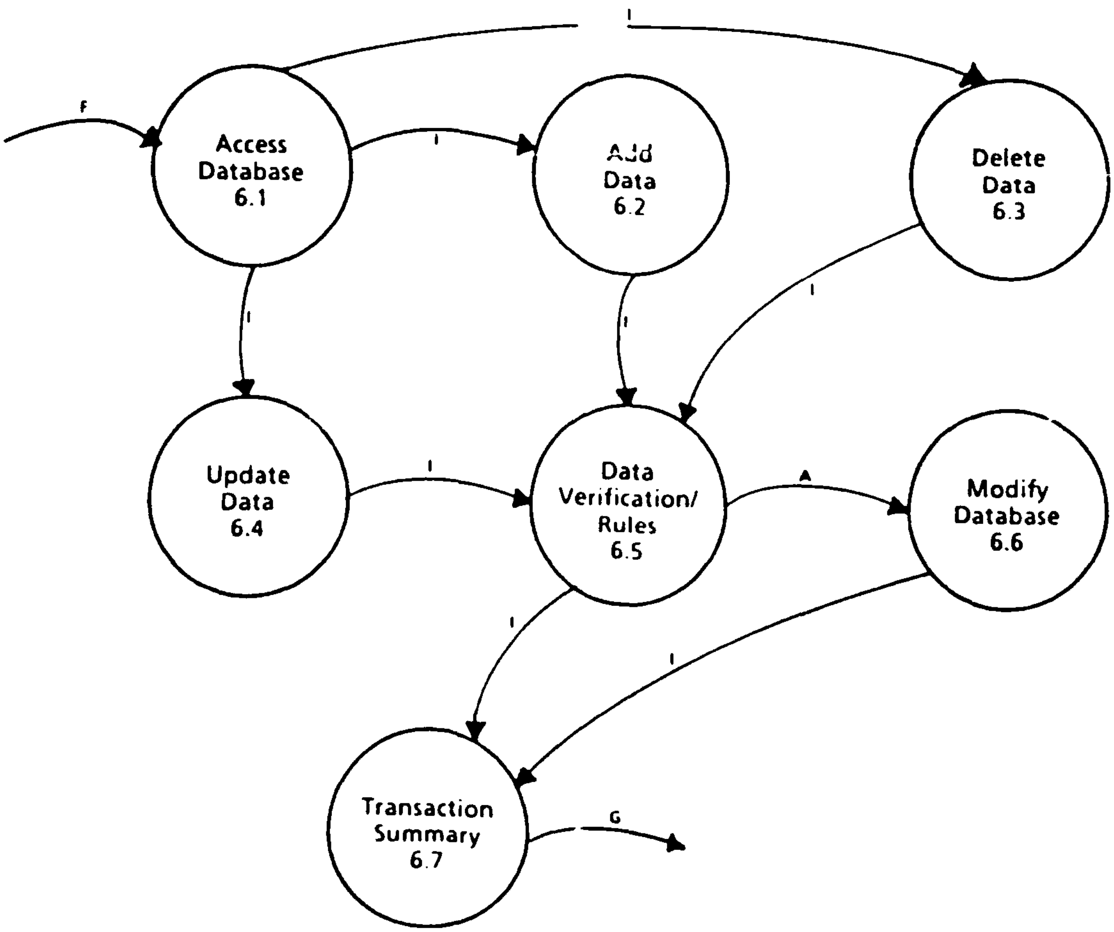

Figure B-4. Level 2: Data element update subsystem.

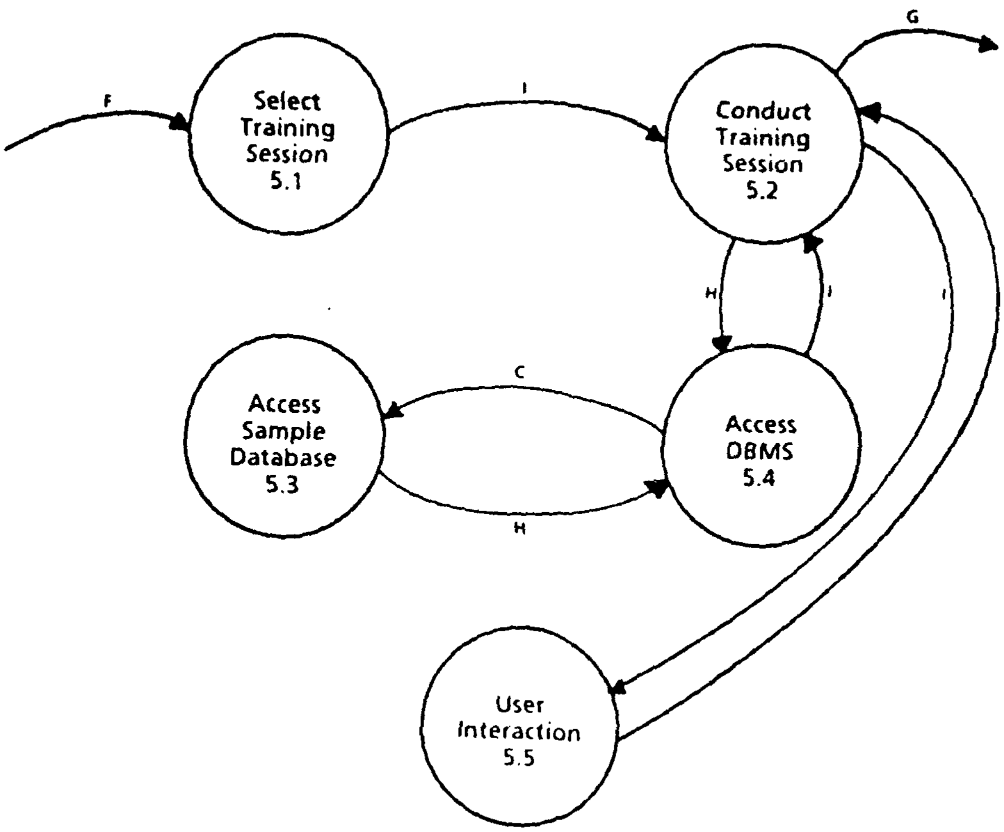

Figure B-5. Level 2: User training subsystem.

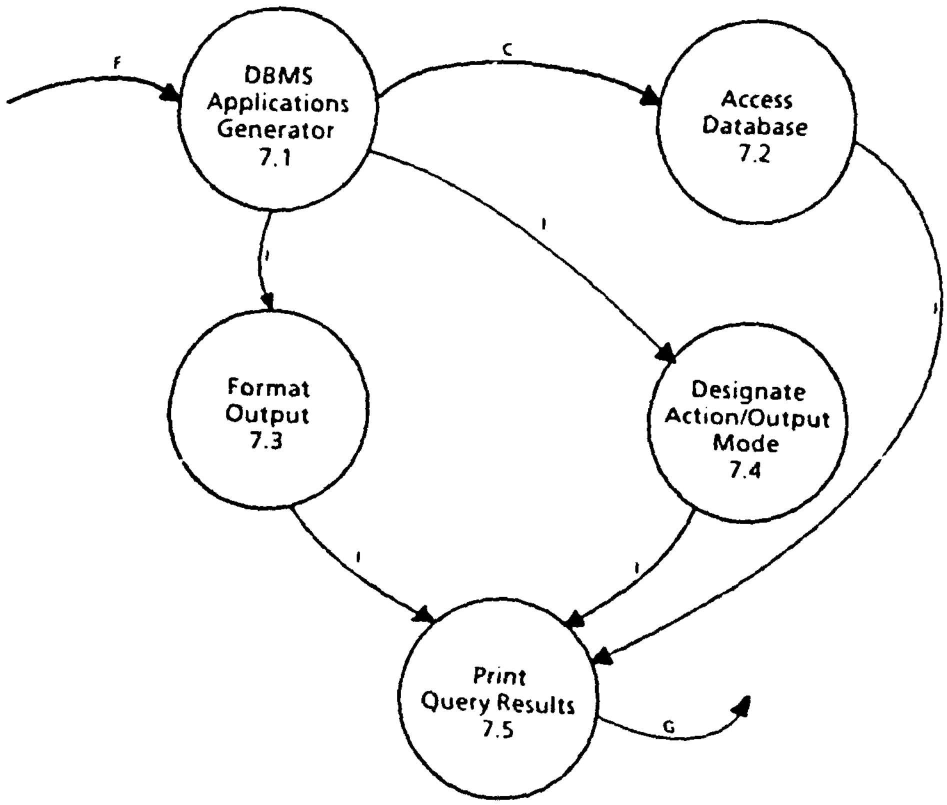

Figure B-6. Level 2: Ad hoc query subsystem.

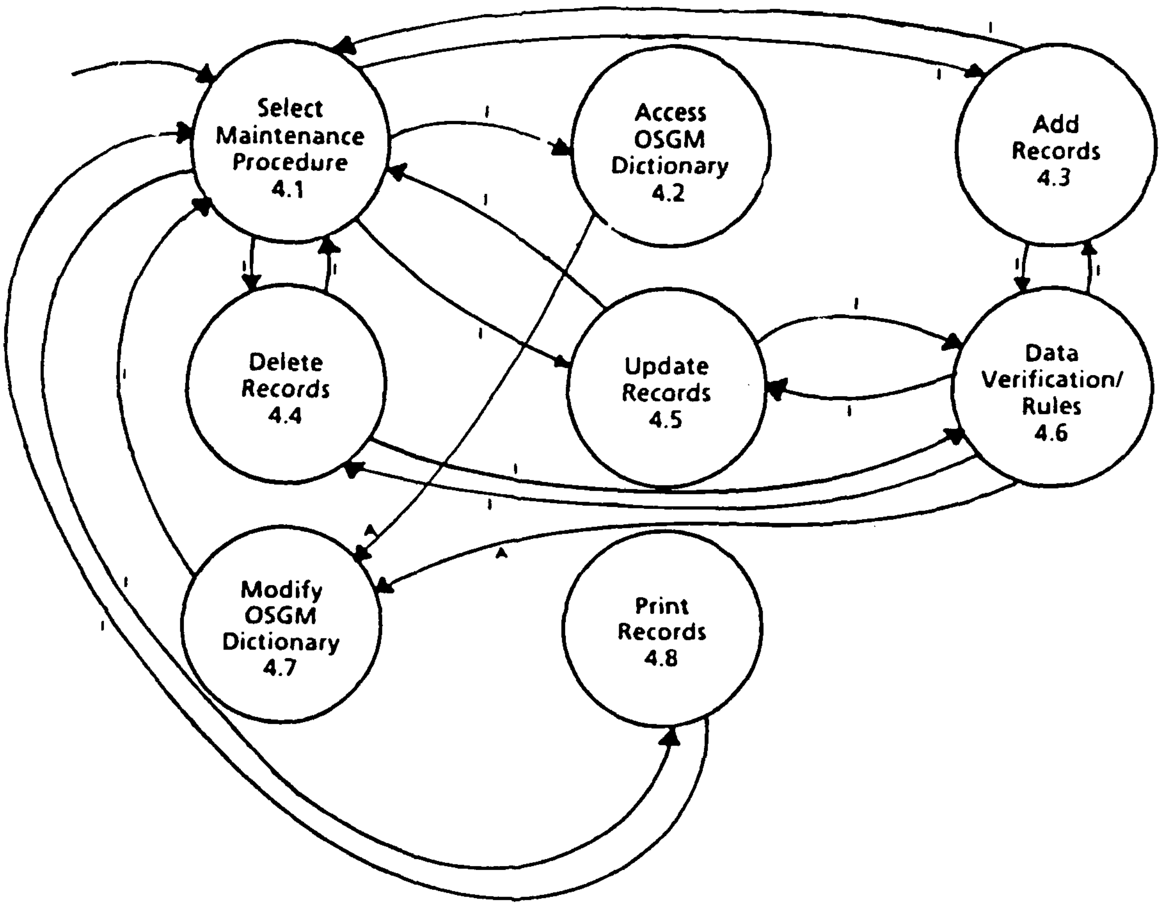

Figure B-7. Level 2: OSGM dictionary maintenance subsystem.

DISTRIBUTION LIST

Distribution:
Commandant of the Marine Corps, Commanding General, Marine Corps Research Development and Acquisition Command (MIS), (MMOA) (2),
Defense Technical Information Center (DTIC) (2)

Copy to:
Commandant of the Marine Corps, Commanding General, Marine Corps Research Development and Acquisition Command (Assistant DC/S M)
Superintendent, Naval Postgraduate School